# WAUKEGAN PILOT PROJE

# SUMMARY UPDATE

February 28, 2001

# PILOT PROJECT OVERVIEW

TWO MAJOR COMPONENTS

1. GROUNDWATER EXTRACTION
   - E UNIT
   - E/R UNIT - PHASE I & PHASE II
2. GROUNDWATER TREATMENT
   - PRETREATMENT
   - BIOLOGICAL

# GROUNDWATER EXTRACTION STRATIGRAPHY

0-5 ft - FILL

5-30 ft - FINE SAND

AT 30 ft - 3 to 6 in. GRAVEL = on top of till unit

GROUNDWATER ENCOUNTERED ~ 4 ft

# GROUNDWATER EXTRACTION WELL SCREEN PLACEMENT

EW - 5 ft WELL SCREEN ON TILL

RW -5 ft WELL SCREEN ON TILL

WN -5 x 1ft WELL SCREEN IN BOTTOM
HALF OF SATURATED THICKNESS
TOP - A, B, C, D, E - BOTTOM

# GROUNDWATER EXTRACTION TEST CONFIGURATION

E UNIT

- 1 EW

- 1 WN

| E/R UNIT | RW | EW | RW |
|---|---|---|---|
| - 3 EW | X | O | X |
| - 6 RW | X | O | X |
| - 2 WN | X | O | X |

# GROUNDWATER EXTRACTION

# E UNIT

# E/R UNIT

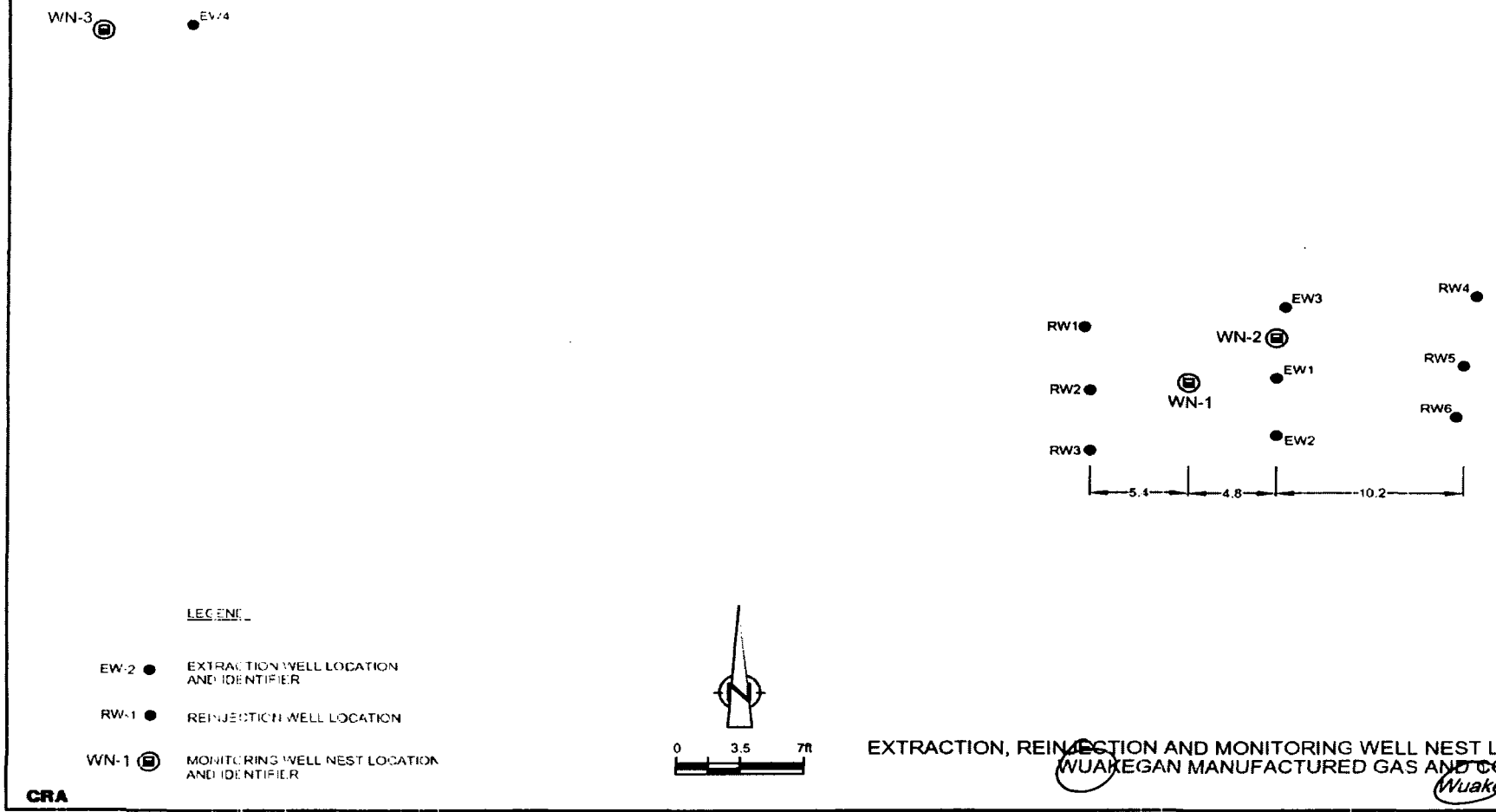


figure 2

EXTRACTION, REINJECTION AND MONITORING WELL NEST LOCATIONS
WUAKEGAN MANUFACTURED GAS AND COKE PLANT
*Wuakegan, Illinois*

# GROUNDWATER EXTRACTION E UNIT OPERATION

| NOMINAL RATE | ON | OFF |
|---|---|---|
| 2.84 l/min | OCT 2 | OCT 9 |
| 2.1 l/min | OCT 16 | OCT 22 |
| 1.42 l/min | OCT 30 | NOV 6 |
| 0.75 l/min | NOV 13 | NOV 19 |

# GROUNDWATER EXTRACTION
# E UNIT
# OBSERVATIONS

- MAX DRAWDOWN 1.75 ft
- EW4 PARAMETER CONCENTRATIONS REDUCED BY ~ 75% DURING THE SECOND WEEK OF OPERATION AND REMAINED AT REDUCED CONCENTRATIONS FOR BALANCE OF TEST INCLUDING OFF PERIODS
- WN3 CONCENTRATIONS INITIALLY f (DEPTH)
- WN3 CONCENTRATIONS MORE VARIABLE THAN EW4, NO OBVIOUS RELATIONSHIP TO PUMPING

# GROUNDWATER EXTRACTION E/R UNIT OPERATION

PHASE I - OCT 9 to OCT 22

EW - 3 WELLS-( 1.00, 1.02, 0.98 l/min)

RW - 6 WELLS- (0.56, 0.57, 0.55, 0.58, 0.55, 0.57 l/min)

PHASE II - OCT 24 to NOV 19

EW - 3 WELLS- (1.03, 1.02, 1.07 l/min)

RW - 6 WELLS- (0.21, 0.21, 0.2, 0.93, 0.93, 0.96 l/min)

# GROUNDWATER EXTRACTION E/R UNIT OBSERVATIONS

PHASE I

- WATER TABLE ESSENTIALLY FLAT IN PILOT STUDY AREA
- BY END OF PHASE I ~ 90% REDUCTION IN CONCENTRATION AT EW1 ~ 75% REDUCTION AT EW2 AND EW3

# GROUNDWATER EXTRACTION
# E/R UNIT
# OBSERVATIONS

PHASE II

- CONCENTRATION REDUCTION MAINTAINED IN PHASE II
- SOME RECOVERY OBSERVED IN WN2E DURING PHASE II AND POST TEST RECOVERY
- [EW1] << [EW2] OR [EW3] AT END OF TEST
  (min. well) (outer wells)

# GROUNDWATER EXTRACTION
# E/R UNIT
# OBSERVATIONS

PHASE II

BROMIDE

- BACKGROUND [Br] PRESENT 10 mg/ℓ
- [Br] FRONT CLEARLY DEFINED @ WN1E, WN1D AND EW1
- [Br] FLUCTUATES AT WN2E

# GROUNDWATER EXTRACTION CONCLUSION

E/R UNIT MORE EFFECTIVE THAN E UNIT

E/R UNIT EFFECTIVELY REDUCES PARAMETER CONCENTRATIONS

Stay down longer than w/ Ext. only.

# GROUNDWATER EXTRACTION NEXT STEPS

DETAILED HYDROGEOLOGIC MODELING REQUIRED TO IMPLEMENT GROUNDWATER EXTRACTION SYSTEM DESIGN

ADDITIONAL CHARACTERIZATION REQUIRED TO DEFINE AREA FOR GROUNDWATER EXTRACTION

# GROUNDWATER TREATMENT

## TWO COMPONENTS

## PRETREATMENT

## BIOLOGICAL

# GROUNDWATER TREATMENT PRETREATMENT

ANDCO NOT AVAILABLE

electrode-As ppt.

FENTONS REAGENT

HUMATES

## RESULT

As removal
9610 ppb → < 400 ppb.

ARSENIC ND @ 0.4 mg/l

AT NEUTRAL pH

# GROUNDWATER TREATMENT BIOLOGICAL

## SINGLE STAGE REACTOR

## TWO STAGE REACTOR

# GROUNDWATER TREATMENT
# BIOLOGICAL
# SINGLE STAGE

OPERATION EXTENDED

HRT: 8 DAYS vs. 1 DAY

SRT: 30 DAYS vs. 15 DAYS

MLSS: 10,000 to 12,000 mg/l vs.

3,000 to 5,000 mg/l

NITRIFICATION ACHIEVED

# GROUNDWATER TREATMENT
# BIOLOGICAL
# SINGLE STAGE

## RESULTS

| PARAMETER | INFLUENT | EFFLUENT |
|---|---|---|
| PHENOLS | 360 | < 0.2 |
| THIOCYANATE | 370 | < 20 |

# GROUNDWATER TREATMENT
# BIOLOGICAL
# SINGLE STAGE NITRIFICATION

| DAY | NH3-N | NO3-N |
|---|---|---|
| 0 | 1660 | 0.5 |
| 12 | 523 | 212 |
| 28 | 1470 | 149 |

Nitrification step not well controlled in one reactor.

# GROUNDWATER TREATMENT
# BIOLOGICAL
# TWO STAGE NITRIFICATION

## FED WITH REACTOR 1 EFFLUENT

| DAY | NH3-N | NO3-N |
|---|---|---|
| 0 | 1600 | 122 |
| 25 | 335 | 82 |

a lot of "bounce" in numbers btwn 0-25 days

# GROUNDWATER TREATMENT CONCLUSION

ARSENIC REMOVAL SUCCESSFUL

AMMONIA REMOVAL SUCCESSFUL

PHENOLICS REMOVAL SUCCESSFUL

THIOCYANATE REMOVAL SUCCESSFUL

# GROUNDWATER TREATMENT NEXT STEPS

## ADDITIONAL TEST REQUIRED TO GENERATE DESIGN PARAMETERS

= Need more time for nitrification step.

# GROUNDWATER EXTRACTION NEXT STEPS

## DETAILED HYDROGEOLOGIC MODELING REQUIRED TO IMPLEMENT GROUNDWATER EXTRACTION SYSTEM DESIGN

- additional modeling
- Nitrification
- addition gw sampling to define area.

## ADDITIONAL CHARACTERIZATION REQUIRED TO DEFINE AREA FOR GROUNDWATER EXTRACTION